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Evaluation of Learning Management System for Users with Accessibility Needs Using Extended Technology Acceptance Model (E-TAM)

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Abstract. Inclusive education aims to provide equal learning opportunities for students with special needs, including the use of a Learning Management System (LMS). The urgency of this research stems from the significant challenges in LMS accessibility, which pose major obstacles for students with disabilities. These challenges include difficult navigation, a lack of screen reader features, and unfriendly interface design. The objectives of the research are to identify and evaluate the factors of LMS acceptance by students with disabilities and provide recommendations. The method uses the Extended Technology Acceptance Model (E-TAM) to identify factors influencing the acceptance of LMS by students with disabilities, such as perceived usefulness, perceived ease of use, and external factors. The findings indicate that System Quality (SQ) has no significant influence on Attitude Toward Using (AT), with the estimated effect size being 1.4%. As an implication, the institutions need to provide easy-to-follow guides to help users with disabilities.

Keywords: learning management system, students with disabilities, technology adoption, e-learning accessibility, quantitative analysis.

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1. Introduction

Based on Permendiknas No. 70 of 2009 [1–3], inclusive education is defined as a system that provides students with special needs the opportunity to learn alongside their peers within the same educational environment. Data from the Ministry of Higher Education in 2022 indicates that there are 1,588 students with special needs across 148 universities. Specifically, in the city of Jakarta, Bogor, Depok, Tangerang, and Bekasi (JABODETABEK) area, there are over 216 students with disabilities, with Universitas Pembangunan Nasional Veteran Jakarta accommodating 12 of them.

Figure 1. Students with disabilities at UPN Veteran Jakarta

Universities widely use a Learning Management System (LMS) [4–6] to support online learning through various features that facilitate the teaching and learning process. Despite its widespread adoption, the development of these systems must give special consideration to students with disabilities. This user group often encounters significant accessibility challenges, including difficult navigation, a lack of essential features like screen readers, and interface designs that are not user-friendly for individuals with special needs [7–9].

To understand the factors that determine an individual's intention to use technology, models such as the Extended Technology Acceptance Model (E-TAM) are highly valuable. This model can effectively predict the degree to which users will accept and utilize a given technology. A study by Fritz M. Ferran in 2021 [10–12], which applied E-TAM to students with special needs, highlighted significant physical and non-physical accessibility constraints in their use of LMS. These constraints included the lack of modified manuals and video tutorials with sign language integration. The successful implementation of any system is contingent on various factors that influence user acceptance of the technology. Therefore, it is important to identify the factors that either support or hinder the inclusive use of an LMS [13–15].

With the rapid advancement of information and communication technology in education, the Learning Management System (LMS) has become an essential element in supporting the teaching and learning process. However, for students with disabilities, the LMS presents unique challenges in their pursuit of equal education. These challenges are primarily related to platform accessibility and the system's ability to meet their specific needs. Therefore, evaluating the LMS used by students with disabilities is crucial to ensure that the system can support the learning process in an effective, efficient, and inclusive manner.

2. Methods

2.1. Sample

A sample is a subset of the population. A representative sample provides an accurate depiction of the population [16–18]. The population for this study consists of 216 students with disabilities in the

JABODETABEK region. The total population is therefore 216 students. The sample size was then calculated using the Slovin formula, as follows:

$$n = \frac{N}{1 + N(e)^2} \ldots (1)$$

where:

n = number of sample
N = number of population
e = precision

Based on this formula, the number of samples obtained is as follows:

$$n = \frac{216}{[1 + 216\,(0{,}05)^2]}$$

$$n = 140 \text{ (rounding numbers)}$$

2.2. Research Framework

This research framework is structured based on a quantitative research design, utilizing the Extended Technology Acceptance Model (E-TAM) as its theoretical foundation. The core concept guiding this study is to analyze the acceptance and use of Learning Management Systems (LMS) by students with disabilities [12–16].

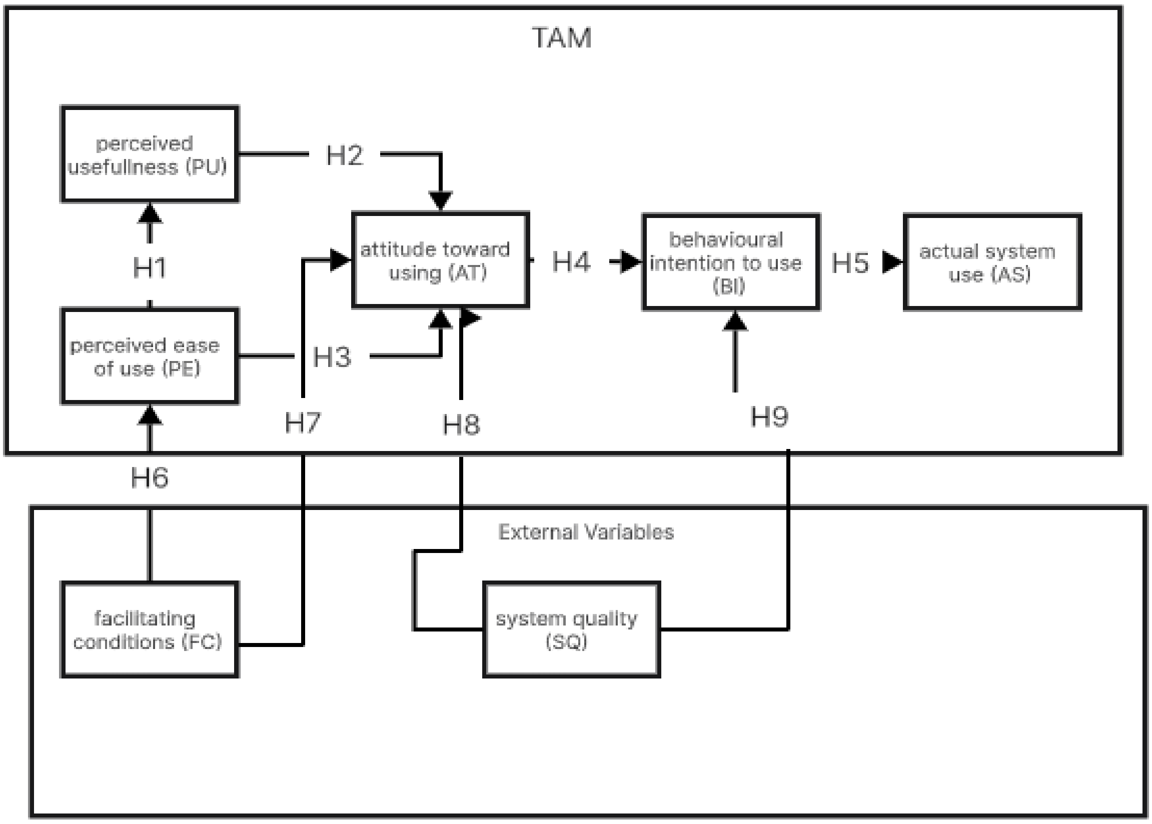

Figure 3. Research Framework

Based on Figure 3, the following hypothesis can be stated:

Table 1. Research Hypothesis

No	Hypothesis
H1	PE has a positive influence on PU in using the learning management system
H2	PU has a positive influence on AT in using the learning management system
H3	PE has a positive influence on AT in using the learning management system
H4	AT has a positive influence on BI in using the learning management system
H5	BI has a positive influence on AS in using the learning management system
H6	FC has a positive influence on PE in using the learning management system
H7	FC has a positive influence on AT in using the learning management system
H8	SQ has a positive influence on AT in using the learning management system
H9	SQ has a positive influence on BI in using the learning management system

2.3. Research Variables

Research variables are defined as the elements or factors selected by the investigator for systematic observation and analysis. The purpose is to collect specific, measurable data, leading ultimately to the formulation of reasoned conclusions. The research variables utilized are detailed in Table 2.

Table 2. Research Variables

Construction	Definition	Manifest Variables	Source	Scale	Questioner
***Perceived Usefulness* (PU)**	using a technology will improve job performance	1. Work faster 2. Performance can improve 3. Easier to use 4. Increased productivity 5. Increased effectiveness 6. The role of existing information technology	[9]	Likert Scale	PU1 PU2 PU3 PU4 PU5 PU6
***Perceived Ease of Use* (PEOU)**	Using a technology will be free from effort	1. Easy to implement 2. Easy to obtain information 3. Interactions are clear and easy to understand 4. Flexible interactions 5. Easy to become proficient 6. Easy to utilize	[10]	Likert Scale	PE1 PE2 PE3 PE4 PE5 PE6
***Attitude toward using* (AT)**	A person's positive or negative feelings when having to carry	1. Enjoy using technology 2. Provide pleasure 3. Enthusiastic	[11]	Likert Scale	AT1 AT2 AT3 AT4

Construction	Definition	Manifest Variables	Source	Scale	Questioner
	out a specified behavior	4. Never get bored			
***Behavioural intention to use* (BI)**	Behavioral tendency to continue using a particular system	1. Plan to continue using 2. Continue to use 3. Expect to continue using	[12]	Likert Scale	BI1 BI2 BI3
***facilitating conditions* (FC)**	The level of trust a person has in the existence of supporting facilities to support a system	1. Necessary knowledge 2. Usage guide 3. Get help from other people	[13]	Likert Scale	FC1 FC2 FC3
***system quality* (SQ)**	The quality of the combination of hardware and software in information systems	1. Ease of use 2. Integration 3. Flexibility 4. Access speed 5. Security 6. System reliability	[14]	Likert Scale	SQ1 SQ2 SQ3 SQ4 SQ5 SQ6

3. **Results and Discussion**

The measurement model was assessed by evaluating convergent validity and discriminant validity. Data processing for this study was conducted using SMART-PLS 3 software. The results of the analysis are segmented, primarily covering assessments of both convergent validity and discriminant validity. Table 3 provides the numerical values obtained for the convergent validity of the study's data [19,20].

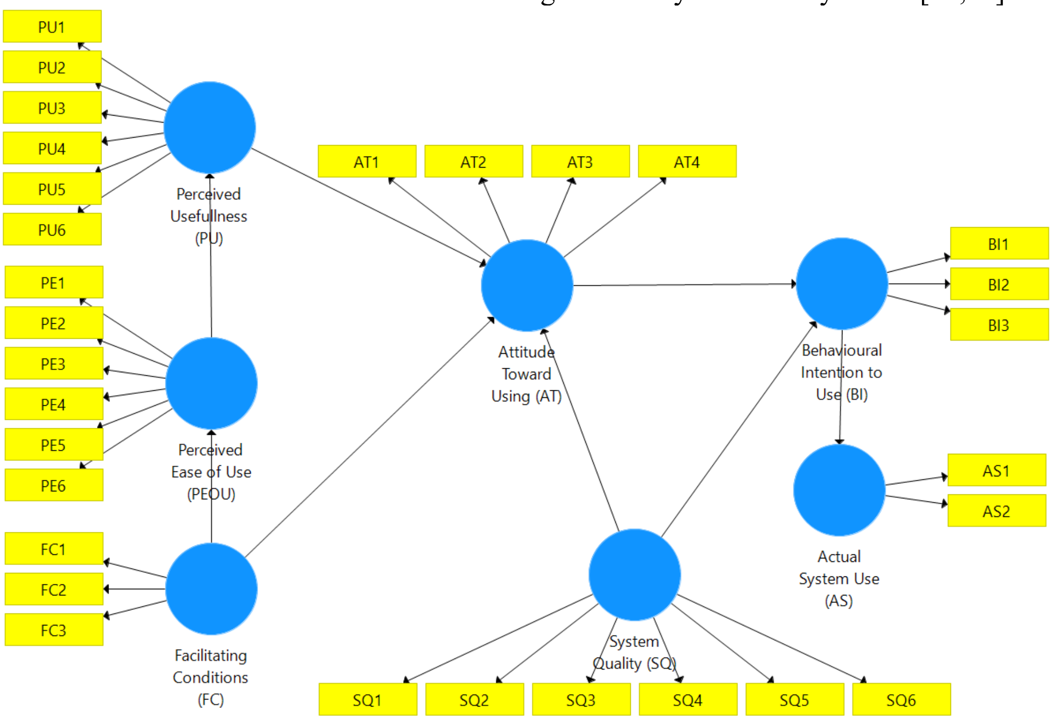

Figure 4. Initial data model

Table 3. Convergent Validity

Constructs	**Items**		**Average Variance Extracted (AVE)**	**Cronbach's alpha**	**Composite reliability**
Actual System Use (AS)	AS1	0.794	0.745	0.657	0.854
	AS2	0.855			
Attitude Toward Using (AT)	AT1	0.864	0.605	0.783	0.860
	AT2	0.918			
	AT3	0.883			
	AT4				
Behavioural Intention to Use (BI)	BI1	0.760	0.606	0.674	0.821
	BI2	0.888			
	BI3	0.883			
Facilitating Conditions (FC)	FC1	0.850	0.687	0.772	0.868
	FC2	0.936			
	FC3	0.956			
Perceived Ease of Use (PEOU)	PEOU1	0.924	0.645	0.890	0.916
	PEOU2	0.940			
	PEOU3	0.896			
	PEOU4				
	PEOU5				
	PEOU6				
Perceived Usefulness (PU)	PU1	0.924	0.515	0.809	0.863
	PU2	0.932			
	PU3	0.945			
	PU4				
	PU5				
	PU6				
System Quality (SQ)	SQ1	0.823	0.560	0.841	0.884
	SQ2	0.771			
	SQ3	0.881			
	SQ4	0.883			
	SQ5				
	SQ6				

The loading factor in convergent validity assessment represents the correlation strength between each indicator and its construct. An indicator is deemed valid for measuring its construct if its loading factor value is ≥ 0.7 or higher (≥ 0.7). Notably, all items in the collected data achieved values of ≥ 0.7. [19,20].

The subsequent evaluation of convergent validity assesses internal consistency reliability using both Cronbach's alpha and Composite Reliability (CR). The acceptance benchmark for both metrics is ≥ 0.7. In the results, two constructs failed to meet the Cronbach's alpha criterion ≥ 0.7 is AS (0.657) and BI (0.674). Conversely, the CR values for all constructs successfully exceeded the ≥ 0.7 acceptance threshold. [19–21].

The final metric for assessing convergent validity is the Average Variance Extracted (AVE). This value reflects the amount of variance in the observed indicators explained by the construct. A larger variance implies stronger representation of the indicators by their construct. The acceptable threshold for AVE is ≥ 0.5. Since all constructs in the collected data exceeded 0.5, the AVE assumption was fully met. [21,22].

The next step in the analysis involves reviewing discriminant validity. The purpose of assessing discriminant validity is to ensure that a reflective construct shares the strongest relationship with its own indicators (for example, when compared to other constructs) within the PLS path model.

Table 4. Fornell-Larcker criterion

	Actual System Use (AS)	**Attitude Toward Using (AT)**	**Behavioural Intention to Use (BI)**	**Facilitating Conditions (FC)**	**Perceived Ease of Use (PEOU)**	**Perceived Usefulness (PU)**	**System Quality (SQ)**
Actual System Use (AS)	0.863						
Attitude Toward Using (AT)	0.786	0.778					
Behavioural Intention to Use (BI)	0.680	0.770	0.778				
Facilitating Conditions (FC)	0.742	0.841	0.758	0.829			
Perceived Ease of Use (PEOU)	0.849	0.855	0.780	0.830	0.803		
Perceived Usefulness (PU)	0.744	0.834	0.737	0.777	0.858	0.717	
System Quality (SQ)	0.777	0.807	0.758	0.775	0.827	0.762	0.748

Discriminant validity is assessed using the Heterotrait-Monotrait ratio (HTMT). If the HTMT value is below 0.90, then discriminant validity has been established between the two reflective constructs. The following table 5 presents the results of the discriminant validity calculations. [22–24]

Table 5. Heterotrait-Monotrait Ration (HTMT)

	Actual System Use (AS)	**Attitude Toward Using (AT)**	**Behavioural Intention to Use (BI)**	**Facilitating Conditions (FC)**	**Perceived Ease of Use (PEOU)**	**Perceived Usefulness (PU)**	**System Quality (SQ)**
Actual System Use (AS)							
Attitude Toward Using (AT)	1.092						

	Actual System Use (AS)	Attitude Toward Using (AT)	Behavioural Intention to Use (BI)	Facilitating Conditions (FC)	Perceived Ease of Use (PEOU)	Perceived Usefulness (PU)	System Quality (SQ)
Behavioural Intention to Use (BI)	1.021	1.050					
Facilitating Conditions (FC)	1.041	1.074	1.046				
Perceived Ease of Use (PEOU)	1.107	1.020	1.003	0.997			
Perceived Usefulness (PU)	1.013	1.038	0.982	0.973	1.000		
System Quality (SQ)	1.040	0.983	0.998	0.958	0.948	0.909	

Based on the resulting matrix in Table 5, seven construct relationships were identified as having an HTMT value greater than 0.90 (HTMT > 0.90). However, the HTMT value is also considered acceptable if its value is less than 1 (HTMT < 1).

The next analysis involves identifying issues of multicollinearity, which signify intercorrelation problems among the indicators. The key metric used to identify multicollinearity issues is the Variance Inflation Factor (VIF). Table 6 below presents the VIF values obtained from the research data. [21–25]

Table 6. VIF Value

Construct	Code	VIF
	AS1	1.315
	AS2	1.315
	AT1	1.616
	AT2	1.534
	AT3	1.577
	AT4	1.601
	BI1	1.432
	BI2	1.303
	BI3	1.264
	FC1	1.506
	FC2	1.564
	FC3	1.810
	PE1	2.509
	PE2	1.891
	PE3	1.855
	PE4	2.242
	PE5	2.324
	PE6	2.494

Construct	Code	VIF
	PU1	1.323
	PU2	1.577
	PU3	1.465
	PU4	1.749
	PU5	1.910
	PU6	1.517
	SQ1	1.736
	SQ2	2.898
	SQ3	2.331
	SQ4	1.395
	SQ5	2.860
	SQ6	2.178

The threshold value indicating the absence of multicollinearity is VIF < 5. Based on Table 6, all data in this study meet the boundary assumption. This signifies that there is no multicollinearity among the indicators. The path coefficients then provide information regarding the direct influence of the relationships between constructs. The results of the construct relationship analysis are presented in Table 7.

Table 7. Relationships between research constructs

	T Statistics	P Values
H1: Perceived Ease of Use (PE) → Perceived Usefulness PU?	30.152	0.000
H2: Perceived Usefulness (PU) → Attitude Toward Using (AT)?	2.277	0.023
H3: Perceived Ease of Use (PE) →Attitude Toward Using (AT)?	2.677	0.000
H4: Attitude Toward Using (AT) → Behavioural Intention to Use (BI)?	5.800	0.000
H5: Behavioural Intention to Use (BI) → Actual System Use (AS)?	13.159	0.000
H6: Facilitating Conditions (FC) → Perceived Ease of Use (PE)?	12.084	0.000
H7: Facilitating Conditions (FC) → Attitude Toward Using (AT)?	3.288	0.001
H8: System Quality (SQ) → Attitude Toward Using (AT)?	1.412	0.518
H9: System Quality (SQ) → Behavioural Intention to Use (BI)	3.636	0.000

The analysis revealed that four construct relationships were not statistically significant, as their p-values exceeded ≥ 0.005. Furthermore, the results of the data processing show that Figure 7 illustrates the final path coefficient model derived from this research. The constructs that were not significant involved System Quality (SQ) on Attitude Toward Using (AT). In contrast, all other construct relationships met the established criteria for statistical significance. Based on the data processing results, Figure 5 represents the final path coefficient model derived from this research.

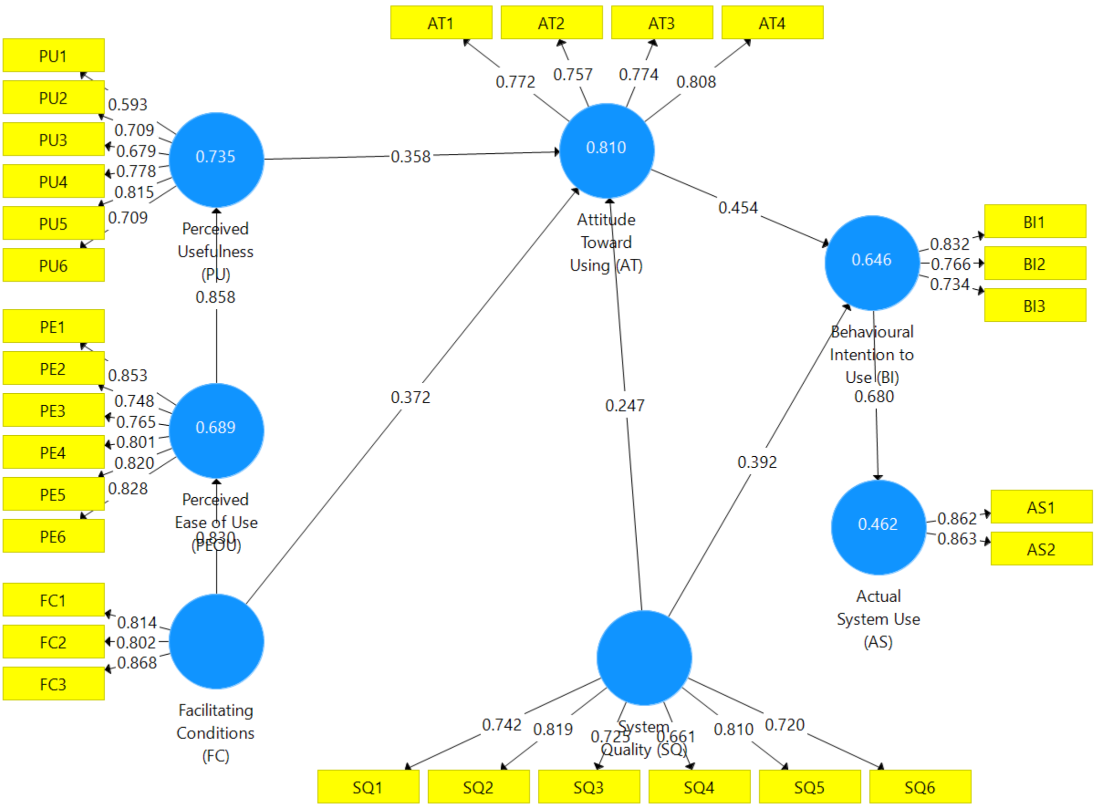

Figure 5. Model test results

The goodness-of-fit of the research model can be determined by examining the R^2 values which is presented in Table 8.

Table 8. R^2 values

	R Square	**R Square Adjusted**
Actual System Use (AS)	0,462	0,459
Attitude Toward Using (AT)	0,810	0,806
Behavioural Intention to Use (BI)	0,646	0,641
Perceived Ease of Use (PEOU)	0,689	0,687
Perceived Usefulness (PU)	0,735	0,733

Adjusted R^2 values of 0.75, 0.50, and 0.30 correspond to strong, moderate, and weak explanatory power, respectively.

4. **Conclusion**

Based on the test results, eight out of the nine proposed hypotheses were found to have a significant influence, while one hypothesis— H8: System Quality (SQ) → Attitude Toward Using (AT) was not significant. The research findings indicate that the general technical quality of the LMS fails to directly form a positive attitude toward its use among students with disabilities. This phenomenon is rooted in the fact that, for this user group, Accessibility serves as an absolute prerequisite. If the LMS fails to meet specific accessibility needs, other technical advantages (such as speed or reliability) become irrelevant, consequently rendering them unable to influence the users' attitude. In the context of students with disabilities, this finding indicates that adopting technology does not automatically free them from required tasks. Therefore, the implementation of technology like a Learning Management System (LMS) for students with disabilities requires comprehensive preparation. This includes not only the technology itself but also the availability of user-friendly guidebooks to facilitate their usage.

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